

## Accelerating landscape change on the slopes and grazing country

Jason Alexandra

Alexandra & Associates, Eltham

### Abstract

Landscape change is emerging as a concept to describe fundamental, wide-scale changes in land use, land management and vegetation management to improve landscape health and to address problems such as loss of biodiversity, salinity and declining water quality. There is an emerging consensus on the scale, urgency and nature of the natural resource management challenges and the interconnectedness of biodiversity, vegetation, ecosystem function and landscape health. However, there is less clarity about what the options are for achieving the desired outcomes, including biodiversity conservation and habitat enhancement.

Many contemporary human processes that change rural landscapes are ad hoc and are not supported by clear, logical policies. Landscape change should be recognised as a deliberate policy reform process — one that is smart, in the sense that it is capable of catalysing outcomes effectively by working with changing community and market values.

This paper reports the findings of an innovative project commissioned by the Goulburn–Broken Catchment Management Authority. The project is exploring options for accelerating land use change using smart incentives, new approaches to attracting substantial investment in revegetation, and better integration of natural resource management and land use planning.

### Keywords

biodiversity conservation, environmental policy, land use, landscape change, natural resource management, reforestation

### A big picture vision for landscapes 2050 looking back

Rob Youl has articulated a truly big picture vision of landscape change that clearly includes biodiversity. Here is an extract from his recent feature in *Australian Forest Grower* on the future of Australasian Forestry and its contribution to reshaping and restoring the landscape (Youl 2002):

As farming became much more intensive, forestry's supporting role grew. The community now sees the regenerated foothills from the Grampians to southern Queensland as a giant belt of forest protecting the high-production agricultural zones in the Murray, Murrumbidgee and other catchments of the Murray–Darling Basin.

From Stawell through Wagga Wagga and Canberra to Tamworth, a substantially complete belt of foothill box-ironbark forest exists, studded with residential clusters of environmentally friendly housing, pockets of intensive agriculture, especially vineyards, and small, not always serious, rural enterprises. Vineyards and other intensively managed sites are inevitably well protected by very wide zones of trees to their rear and flanks, with man-made wetlands downslope to modify runoff.

In the south there are also extensive well-managed plantations of sugar gum, utilised for firewood, charcoal, biomass energy and utility timber production, as are many commercial stands of box-ironbark forest.

The scene was different at the turn of the century, with wool production expiring on steeper country, and the region suffering from overclearing, salinity, erosion, fragmentation of bushland reserves and opportunistic and badly planned subdivision.

Revolutionary landcare plans, developed by the regional community with technical help from government and industry, recognised that the landscape was in transition from farming to farm forestry, recreation, residential opportunities, conservation, tourism, and niche farming.

The community seized on the changing rural economy, the influx of city-based landowners with their capital reserves and altruism, and the nation's realisation in the early 2000s that, only by facilitating massive adoption of perennial crops, could we conquer salinity.

National and regional government, with catchment management authorities, provided seeding funds, with generous investments from several philanthropists, to develop new community enterprises.

Municipalities played their part, enforcing concomitant environmental protection wherever intensive industries established, and ensuring subdivision for recreation and rural-residential developments included substantial direct-seeding with indigenous tree species.

Over the next decade, the initially reluctant forestry investment industry changed tune, and, in conjunction with some leading global finance houses and ethical investors, joined the community businesses. Together they initiated an environmental forestry program that led the world for a decade, making the most of emerging markets for greenhouse credits and biodiversity, salinity and water catchment bonds.

People smile recalling Benalla's early Regent Honeyeater program, initiated by an idiosyncratic conservationist, Ray Thomas. Regent Honeyeater numbers in this beautiful landscape have risen manifold, as has the population of Grey-crowned Babblers. The secret: numerous new farm forests, with understorey, have linked bushland fragments and waterways and multiplied bird habitat.

## Turning the vision into reality

### *The GBCMA Landscape Change Project*

The Goulburn Broken Catchment Management Authority has commissioned a team of consultants to undertake a project to design the reforms and investment framework to help turn Rob's vision into reality. This paper is based on the findings of this innovative project, which involved a rapid assessment of the options for accelerating land use and landscape change in the Goulburn Broken Catchment. The geographic focus of the work is the Goulburn Broken Catchment, especially in the mid and upper catchments. A case study is planned for the slopes and ranges of the Strathbogie Ranges, but the findings will be relevant to most of Victoria and many parts Australia.

The project is exploring various tools, mechanisms or policy instruments and how to apply them, because while there is a general understanding about using policy instruments such as regulation and incentives (Young et al. 1996, Industry Commission 1998, ACG 2001), there has been little work done tailoring these to landscape change for specific regional circumstances. Furthermore, rarely have policy measures been devised explicitly to generate or accelerate measurable progress towards regionally identified sustainability goals (Alexandra 2000).

The project explores:

- the need for new approaches to change
- options for using a range of innovative policy instruments
- new business structures and models
- financial and investment strategies
- use of the statutory planning system
- options for redefining and marketing a range of property rights
- innovative investment arrangements to fund landscape change, etc.

and aims to:

- clarify and further develop concepts of landscape change

- identify and document existing processes of change influencing natural resource management
- identify and document opportunities for generating or accelerating change
- evaluate current and future options for landscape change
- review and evaluate existing mechanisms for achieving natural resource management outcomes
- review, evaluate and recommend alternative mechanisms
- develop a 'prospectus' to attract investment to fund/invest in landscape change
- develop the 'vegetation bank' concept into an operational system
- undertake a case study in the Strathbogie Ranges to analyse options

The project will document options for:

- funding natural resource management — to establish a 'vegetation bank' so it can attract and manage sufficient investment to finance landscape change on a scale sufficient to achieve natural resource management outcomes
- aligning change mechanisms — to systematically match priorities for changes in land use
- choosing and using mechanisms — to develop improved capacity for choosing and using new and existing mechanisms (policy and planning instruments) to generate landscape change.
- linking statutory and catchment planning — to achieve natural resource management outcomes
- achieving landscape change in a coordinated targeted and cost effective fashion
- using the rich spatial information available to support implementation of the various natural resource management strategies — salinity, water quality, biodiversity, etc.
- monitoring and evaluating — how to monitor and evaluate key indicators of natural resource management outcomes.

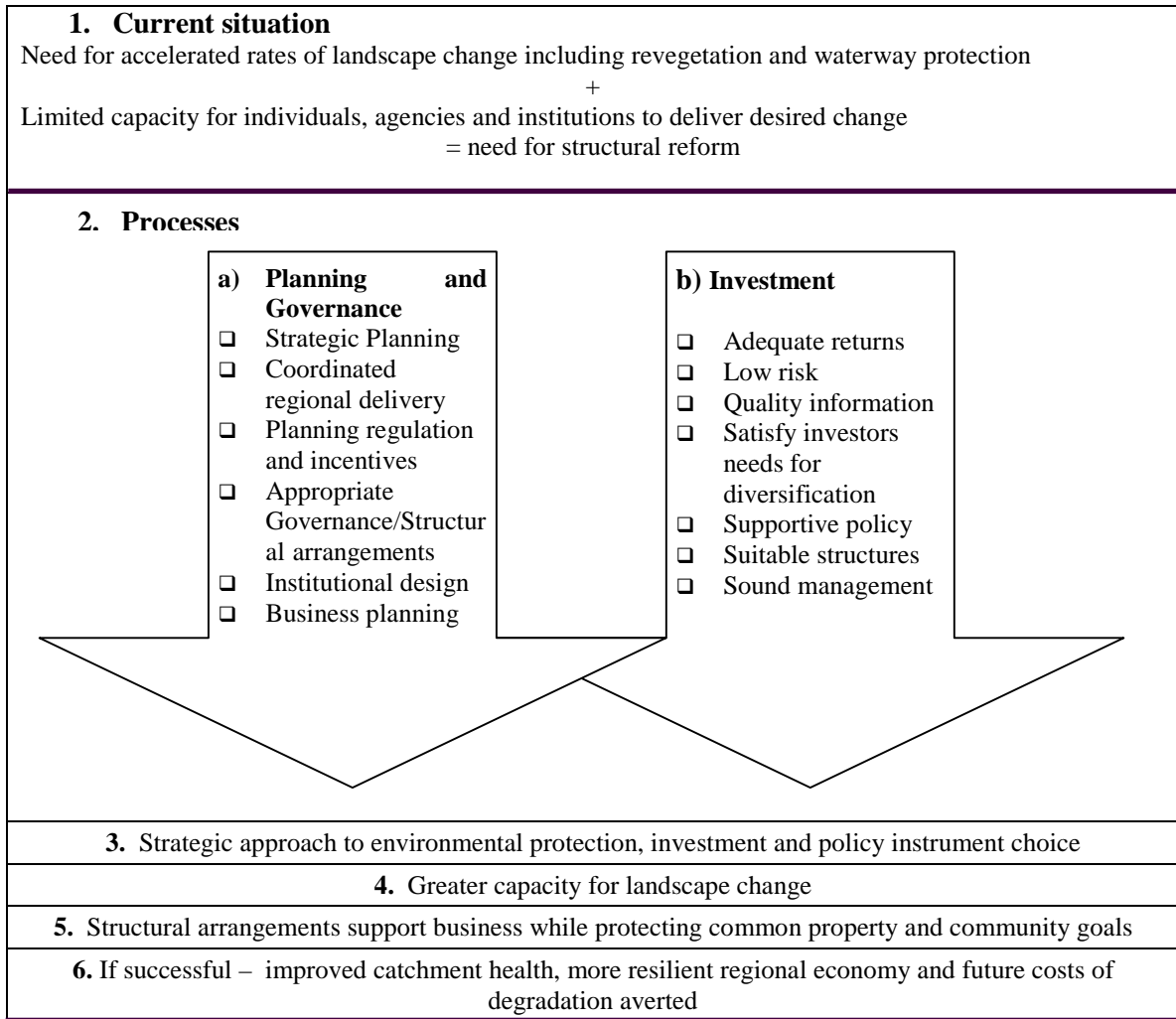
#### *Project logic — landscape change as policy implementation*

Many interrelated processes affect natural resource management within the Murray–Darling Basin generally and within the Goulburn Broken region (see summary below). Not all of these will result in positive landscape change. The project's research has identified the importance of coherent reform processes if policy intent is to be achieved. Stated sustainability intentions in policy documents are not sufficient; there must be follow through in all aspects of government if complex sustainability goals are to be achieved (ANZECC 1992, Dovers 1996, Productivity Commission 1999, Dovers and Mobbs 1999, Dore and Woodhill 1999, ACF 2000).

The underlying questions for the project are:

- 'How much change is needed to achieve the desired landscape outcomes as defined in NAP Regional Targets or similar?'
- 'How is this to be achieved?'
- 'What reforms are required?'

These key questions and the underlying logic we are attempting to apply to the project are represented in Figure 1. The two parallel arrows represent the primary activities of attracting investment and ensuring the design and adoption of an appropriate and supportive policy framework.



**Figure 1** Project logic.

**The need for new approaches to change**

The incorporation of ecological sustainability into policy has been *ad hoc*, incomplete and tentative. The central problem is that Australian governments have yet to put in place a comprehensive, integrated and far-sighted way of promoting the ecologically sustainable management of natural resources (Industry Commission 1998).

*Land and water reforms*

Agricultural businesses are the dominant users of land and water resources in Australia (ABS 1996). The environmental challenges facing rural lands and land-based industries are huge and widely recognised (Commonwealth of Australia 1996a, MDBC 2002). The stakes are high in both economic and ecological terms, with numerous degradation trends, such as dryland salinity, loss of biodiversity and declining water quality well established. These environmental challenges facing natural resource managers and agriculture are well documented (for further information see Commonwealth of Australia 1996; Industry Commission 1998; LWRRDC 1988; MBDC 1999a, 1999b, 2001, 2002).

For well over a decade governments have been making major investments in attempting to improve natural resources management in rural Australia. Landcare and the related initiatives<sup>1</sup> of the last decade have sought to achieve sustainable land use through a wide range of mostly

<sup>1</sup> 'Landcare' is used as an umbrella term as there have been a range of government funded programs aimed at sustainable land use or sustainable landscapes, such as those funded by the Natural Heritage Trust.

voluntary programs. Most effort has focused on encouraging farmers to change through the use of informative, incentive or facilitative approaches to change (see for example Earl et al. 2001, GBCMA 2001). The Goulburn Broken Catchment Management Authority has been recognised as a leader in this field by being awarded the prestigious Riverprize in 2001.

There have also been major policy reforms in water resources management (Alexandra 1992, Industry Commission 1992), fisheries and forestry, and consequential structural changes. However, structural changes in land use and dryland agriculture have been largely determined by 'market forces' and have been assisted or even hindered by some intervention by Governments, such as drought relief and the Rural Adjustment Scheme (Alexandra 1996, 1997). This is despite the fact that dryland agriculture is the dominant industry managing natural resources and that significant demographic and structural changes are inevitable because of declining farm incomes and aging populations (MDBC 2000a, Landmark 2002, Rural Atlas BRS 1999, and Barr 2002).

There is a growing acceptance that current rates of positive land use change are insufficient to stop the decline of catchment health and that new approaches are needed (MDBMC 1999, Stirzacker et al. 2000, MDBMC 2000b, 2001).

The fundamental difference between dryland agriculture and the other resources sectors that are subject to planned reform is that dryland agriculture operates on the basis of private property rights — land tenure — and all the presumed rights associated with this form of property right. In contrast, water, fish stocks and native forests are predominantly publicly owned and managed resources (Young and McCoy 1995).

Although the nature of the property rights and responsibilities bestowed on private property continue to evolve in rural Australia (e.g. native title, water and forest rights), reform in dryland agriculture is fundamentally different to reforms in the forestry, water and fisheries sectors, in which industries are based on regulated access to state-owned and allocated resources.

In contrast, catchment or landscape health is a currently ill defined 'common property'.<sup>2</sup> We are more familiar with the consequences of declining landscape health — salinity, extinction, reduced water quality — than we are with the idea of using structural reform to drive positive change or protection of this common property. This project explores how we could use a range of policy instruments to generate positive or beneficial landscape change via markets, incentive and regulation.

### *Vegetation plans*

Native vegetation protection and management is now backed by a comprehensive set of legislation, policies, strategies and regional plans. A duty of care is explicit in the *Catchment and Land Protection Act 1994*. Victoria has had Native Vegetation Retention controls since 1989, and a Biodiversity Strategy since 1997. And it has endorsed a Native Vegetation Management Framework (NRE 2001), accompanied by 10 Regional Native Vegetation Plans (one for each Catchment Management Authority).

The framework and the plans adopt the 'net gain' principle. Individual plans specify significant targets for increases in vegetation cover. Greening Australia Victoria has estimated that planned increases in vegetation cover per Catchment Management Authority region range from 13 000 (East Gippsland) to over 600 000 (NCCMA) hectares. Approximately 1.4 million hectares need to be revegetated if all these targets are to be met.

### *Vegetation decline and species extinction*

The aim for Victoria is now for no net loss of native vegetation. But although significant progress has been made in protecting native vegetation, it is estimated that an average of 2500 hectares a year has been cleared since clearing controls were introduced in 1989 (DNRE, unpublished data). Broad-scale clearing is not the only pressure. Invasions by weeds, predation of native fauna by feral animals, changes in hydrology, and infection by pathogens such as

---

<sup>2</sup> Common property is used here in inverted commas because catchment health has not been clearly defined as either private or common property.

*Phytophthora cinnamomi* are all changing species compositions and leading to further degradation.

Furthermore, the quality of much remnant vegetation continues to decline. The loss of vegetation due to urban expansion and the continuing decline of widely spaced remnant trees in farm paddocks are of particular concern. The impacts of the multiple causal factors can be visualised when we consider the problems posed by the accelerated loss of that wonderful icon of rural Victoria, the magnificent, solitary, stately paddock tree. There are millions of such paddock trees, but on current trends it is only a matter of time before they disappear, further changing the aesthetic nature and ecological functioning of many rural landscapes.

Public or private investment in environmental restoration plantings is required not only for salinity but also if we are to prevent the extinction of up to 50% of small woodland bird species. Many parts of the Australian landscape need major restoration (Seddon et al. 2001). While we have little opportunity to undo the clearing of the past, we can reduce the impacts through revegetation. If this is done insensitively, however, it could also threaten important species, communities or habitats. New and more sensitive approaches to designing plantations are required. If plantations become more common in the medium and lower rainfall agricultural landscapes, those designing and siting them will have to confront many issues with regard to the relationships to existing vegetation. Multiple-purpose forestry will need to be more sensitive to the value of remnants, as even small patches as well as individual remnant trees have proven to be valuable as habitat (Lindermayer 2001). Secondly, the issues of 'weed trees' and genetic pollution must be confronted. The desirable features of preferred plantation species — vigour, resilience and adaptation to conditions — are what make them potential weeds. Thirdly, it is important to recognise that the new plantations will be growing in already stressed landscapes and that there are decline trends which are frightening in their magnitude and implications — rising water tables and the loss of species of immeasurable value. The extinction debt in the sheep wheat belt is huge, with some learned ecologists predicting the extinction of up to 50% of the woodland bird species (Seddon et al. 2001). The loss of plant species because of salinity is predicted to increase dramatically, and many small mammals are already extinct or threatened.

### *The Goulburn Broken Native Vegetation Management Strategy*

The need for extensive protection and enhancement of native vegetation is recognised in the Goulburn Broken Native Vegetation Management Strategy. The challenges of realising these are vast, and the Strategy's goals are as follows:

- Maintain or increase the extent of all native vegetation types, using the 1999 extent as the base, in keeping with the goal of net gain listed in Victoria's Biodiversity Strategy.
- Enhance the quality of existing native vegetation by managing 90% of native vegetation cover according to best management practices by 2010.
- Increase the cover of all 'endangered' and applicable 'vulnerable' ecological vegetation classes to at least 15% of their pre-European cover by 2030.
- Increase the viability of threatened species and the extent and quality of threatened ecological communities.

## **Options for landscape change — the theory**

### *Types of change and change mechanisms*

If we look over a large enough time frame — say, several decades — we recognise that landscapes, economies and communities are in a continuous state of change that is driven by many factors, including changing markets, technology and community values. The structural characteristics of rural industries continue to change and evolve (MDBC 2000a).

Governments tend to regulate, encourage or support change in many different ways, depending on commonly held perceptions of what kinds of change are valuable or desirable. Australian governments have consistently intervened in 'market-driven change' in agriculture via a wide range of mechanisms, including:

- infrastructure provision
- research and development

- education and extension
- statutory marketing bodies
- land use controls
- low interest loans
- taxation treatment
- incentives and regulations
- ‘structural adjustment’ programs such as the recent billion dollar dairy package.

Governments continue to drive some large-scale landscape changes via taxation rules that provide incentives to some land uses, such as blue gum plantations. At a wider scale, the tax system has a big bearing on both the scale and the kinds of investment favoured by business. They also continue to provide massive direct and natural resource subsidies to industry which are rarely accounted for (Environment Australia 1996, Industry Commission 1996, ABC Radio National 2002). Local governments also play an active role in directing land use change by limiting and restricting subdivision to certain areas or setting minimum lot sizes.

In combination, the ‘rules of the game’ used by governments are described as ‘policy settings’, and individual mechanisms are referred to as ‘policy instruments’.

While there is much rhetoric about free markets and the problems of interventionist governments, in reality all markets are conditioned to a greater or lesser extent by the policy settings of governments. The use of policy instruments is not independent of the market but works in conjunction with market processes. Governments should aim to establish ‘smart regulation’ and elegant policy settings which enhance the ability of the markets to deliver to the community what it wants and needs.

This project aims to not only look at the policy instruments but also to investigate the dynamic relationship between the signals and instruments used by governments and the choices and investment made by the private sector that together may result in beneficial landscape change.

It is also important to recognise that there are well-established trends in agriculture, primarily the reducing terms of trade for farmers, increasing economic efficiency and reduced employment, greater intensification in many rural industries (e.g. viticulture, horticulture, dairying) and increasing extensification in the broadacre industries (Landmark 2002).

### *Types of policy instruments*

‘An assessment of the current suite of instruments needs to consider their efficiency and effectiveness in achieving the desired objectives; and also any equity issues such as the impacts the instruments have on various stakeholders (i.e. the winners and losers).’

— ACG (2001)

Deliberate landscape change is essentially a policy implementation process which needs to identify the desired goals and the means of achieving those goals (ACF 2000). The effectiveness of any landscape change strategies will therefore depend on many factors, including:

- clear and coherent policy goals
- cooperation between the three spheres of government
- effective regional-scale entities
- willingness to use an appropriate mix of policy instruments
- capacity to harness the dynamic relationships between public policy and private enterprise decisions.

Policy instruments can be defined as mechanisms used by governments to influence behaviour of individuals and businesses. Governments have a wide range of instruments available to them to address natural resource management problems, although not all have been used widely in Australia for a range of reasons (ACG 2001).

Policy instruments can be grouped into categories according to their modes of action. We have chosen four categories:

- Informative
- Incentive-based
- Compliance-based
- Market-based.

Table 1 demonstrates the diversity of instruments available. (Note that policy implementation processes usually use elements from different categories.) Generally, a suite or group of mechanisms are used to drive effective change. For example, in response to the road toll a combination of mechanisms or instruments have been introduced: new driver education, graphic Transport Accident Commission advertisements, more resources for the enforcement of road laws, changes to laws, increased penalties, and funds for improved road design and construction.

**Table 1** Instruments to influence landscape change – land use behaviour. (Adapted from Young et al. 1996, ACG 2001, and Productivity Commission 2002.)

<b>Informative</b>	<b>Incentives and assistance</b>	<b>Legal compliance</b>	<b>Market-based Mechanisms</b>
Community education	Grants and subsidy to match private investments	Standards & penalties	Emission markets, e.g. carbon markets
Education and training	Incentives and subsidies	Regulation and prohibition	Catchment or environmental levies (Brisbane City Council)
Accreditation systems: EMS, QA, etc.	Stewardship payments	Conditional permits and licensing	Charges for resource use, e.g. pastoral leases
Rating standards systems (5 star appliances)	Low interest loans	Resource allocations and entitlements	Tradeable rights and permits, e.g. water rights
Research and development (R&D)	Investment tax concessions and preferential tax treatments	Covenants and management agreements	Tradable development rights
Information provision (brochures, media, field days, etc.)	Tax deductibility	Contracts	Creation of new property rights
Best management practice guidelines (BMP)	Cost transfers	Land use and development planning, e.g. statutory planning	Performance bonds or refund, e.g. mining cleanup
Monitoring schemes (salt watch, stream watch)	Infrastructure provision	Regulatory arrangements	Offset schemes
Peer group learning e.g. landcare groups, progaze	Bush tenders	Clearing controls	Revolving funds
Industry codes: voluntary self regulation	Cost sharing contracts	Pollution licences	Clean-up levies
Demonstration projects and demonstration farms, e.g. sustainable grazing systems	Production subsidies	Taxes and charges	Industry self regulation
	Rebates, e.g. rate rebates	Codes of practice: mandatory	Competitive contracts
	Compensation	Fines and forfeiture of rights	Dedicated taxes, e.g. fuel taxes
		Harvesting rights	Ambient pollution charges

Different mechanisms or instruments can be used to generate synergies by designing programs of policy implementation that combine different kinds of instruments.

It is too simplistic to think that one approach or mechanism could generate landscape change. It is generally accepted that individuals within communities are motivated by different goals and respond to different kinds of signals, and that not all will respond to information or incentives. Individuals and enterprise managers have different perspectives on what is going on

in a catchment and what represents 'good land management'. They inevitably see things differently and take different types of advice or guidance on risks and opportunities. Therefore we need a range of approaches, which might appeal to altruism or profit motives or share in cost of public and public benefits via some kind of cost sharing contract (AACM 1995, MDBC 1996).

Furthermore, policy implementation is not simply a 'set and forget' exercise but one which requires ongoing monitoring, review and adaptation. Dovers and Mobbs (1999) identified the importance of developing cost-effective policy implementation processes that have a capacity for 'policy learning'. They outlined the need for a policy equivalent of adaptive management which uses the best available knowledge to design policy reforms, and then monitors the impacts and effectiveness of various policy options so that they can be adapted as required, based on the feedback received.

### *Mixing types of instruments*

'An optimal mix of policies, strategies and incentives is required including a regulatory safety net that prevents significant reversible decline ...'

Young et al. (1996)

Binning and Young undertook detailed research into the range of instruments that can be used to implement policies for the management of native vegetation on private land (Binning and Young 1997, Binning and Young 1999, Binning and Feilman 2000). Binning et al. (2000) then evaluated the application of these incentives to address both the economic and institutional impediments to agroforestry.

A key finding of their work is that it is desirable to use a mixture of policy instruments available from the 'toolbox' that focus on:

- people — tools that can be used to motivate and retain landholder support
- finance — the incentives that share the costs
- security — regulatory, legal and voluntary property right instruments.

They argued that 'these categories provide a powerful framework for evaluating policy instruments because there is considerable evidence that mixes of policies that harness the synergies between educational (people), regulatory (security) and economic incentives (finance) are likely to be more effective both in terms of cost and environmental outcome than the use of single instruments' (Binning et al. 2000).

This insight is critical, because they claimed that 'policy makers are generally biased to one type of instrument based on their disciplinary training and professional experience. For example, lawyers and planners tend to prefer regulation and land-use planning, economists incentive instruments, and social scientists education and participatory processes. A critical management issue in developing successful policy approaches is to bring these differing perspectives together and to seek out complementarity.' (Binning et al. 2000).

They argued that an effective approach to implementation of policy is based on an orderly use of the combined groups, typically in the following order:

- Raising awareness through education is a critical first step, but recognising that this has little direct influence on short-term behavioural change.
- Financial incentives are only likely to be effective after awareness is raised and landholder attitudes shifted.
- Regulations which require sufficient community support to work well.

However, they also recognised that other ordering is desirable in different circumstances; for example, using incentives to promote acceptance of new regulations required to secure large structural changes in a short period of time.

### *Market measures*

Market measures are instruments designed to create, stimulate or work with markets. For example, the creation of tradeable water rights in Australia has created markets for irrigation water where none existed previously (Industry Commission 1992). Likewise, a carbon market is emerging around the world which may stimulate investment in reducing or sequestering atmospheric carbon dioxide.

There is considerable interest in developing markets for a range of ecosystem services. If these emerge it is conceivable that in the future governments or others will pay for generating an environmental outcome, or maintaining an ecosystem service such as improving water quality or enhancing habitat (Alexandra and Hall 1998, ACG 2001). This idea is now gaining greater acceptance, and options for creating markets for ecosystem services have been reviewed recently (JVAP 2002, Productivity Commission 2002). The Commonwealth government is providing funding for trials of market mechanisms. As part of the National Action Plan for Salinity and Water Quality (NAP) it has announced a \$5 million trial of 'market measures'. Similarly, the Victorian government is experimenting with the use of auction systems for changing the management of areas of native vegetation (Productivity Commission 2002).

It is also important to note that any change in land use on the slopes from rough grazing to dedicated production of ecosystem services only has to compete with the profitability of the grazing. Many landowners may be willing to shift their production from wool to water quality if assured of a comparable income. Such changes are more likely to be inhibited by a lack of a structured market for ecosystem services rather than simply the willingness of landowners to adopt change. Binning et al. (2000) proposed that, for ecosystem markets to operate, brokers need to link buyers with sellers and to define, bundle or unbundle ecosystem services as required.

## **Existing processes of change influencing natural resource management**

### *Current processes of change*

For the purposes of this project the catchment can be grouped into five dominant land use systems or zones:

- 1 irrigation areas to the north — horticulture, dairying, etc., with associated wetlands and riverine landscapes
- 2 plains — cropping and grazing, occasional low hills, vegetation along riparian corridors and roadsides
- 3 the broad valleys and lower slopes of the mid and upper catchment
- 4 slopes and ranges used for grazing
- 5 forested ranges.

In each zone different processes are driving landscape change. The project is primarily concerned with Zones 2, 3 and 4, because there have been extensive planning and change processes focused on the forest and irrigation areas, in part driven by the national reform processes (the Water Reform Agenda and the Regional Forests Agreements).

The opportunities for generating landscape change differ in each land use system, so the landscape change mechanisms will either be different or be applied differently in each. Priorities for intervention also differ. The medium-rainfall woodlands that remain are typical of much of the Goulburn Broken Catchment Management Area and include of the most valuable vegetation communities in Australia (Hobbs and Yates 2000). While protecting remnants is important, active programs of regeneration and revegetation will be required to prevent further decline and to secure catchment and ecological health for the region and its dependent fauna (Bennett 1990, Bates 2001, ECC 2001).

In the past most rural landscapes were defined as being production systems, and so rural and natural resource management policy focused on ways of changing these production system and thus the natural resource management outcomes. The basic premise adopted and promoted by agriculture and natural resource agencies was that farmers were free and independent decision-makers making rational decisions in the best interest of their business and their land.

**Table 2** Summary of the drivers of natural resource management change.

<b>Types of change</b>	<b>Scale and occurrence in GB CMA</b>	<b>Natural resource management influence - outcomes</b>	<b>Comments</b>
Increasing scale of large farm businesses – multi tenure	National– typically in irrigation and cropping zones	Fewer more professional managers	Slow processes of adjustment. Busier managers
Many part time and hobby farmers	national -	variable	Off farm income – tends to drive diversification
Age of many graziers	National/Catchment wide - typically in mid to upper catchments	Anticipate generational change–pressure to subdivide land to smaller titles	Risk adverse and unlikely to change by education –
Many absentee land owners	Catchment wide -	Much land is leased and has no full time owner-operator	New forestry may be able compete with lease rates
Increase in diversification of enterprises	Catchment wide – tends to be land system specific	Intensively managed units more important to regional economy	Tends to result in selection of preferred sites for intense industry
Increasing area of private forestry - plantations	Upper catchments	Rarely located to generate maximum natural resource management outcomes	Tends to go to higher rainfall ends of valleys
Increasing interest in integrated farm forestry	National	Variable	Relies on individual interest and capacity
Transferable water rights	National/Catchment wide	May result in significant movement of water to 'non traditional' irrigation areas	Further adjustment ongoing
Development of eco-system market theory	National	May result in markets for services rather commodities from the landscape	Increasing interest will support trails and further investment
Redefining land owners rights	Catchment/State wide	Vegetation clearance and water harvesting rights have been redefined	'Rights' to subdivide may be the next debate
Hardening of natural resource management targets	National/MDB/Catchment wide	May stimulate land use reforms particularly in salt export zones	Sanctions and incentives not yet well defined
Plans to leverage private investment for natural resource management	National	Should result in increased efficiency of public dollars	Requires innovative approaches to natural resource management
Urban rural wealth disparity	National	Rural landscapes are becoming lifestyle, production and mixed economy zones	Dynamic nature of mixed urban rural fringe
Victorian native vegetation framework	Victoria	Defines vegetation management and revegetation policy targets	How will goals be met in a timely and cost-effective fashion
Off reserve conservation focus	National	Recognition of the importance of biodiversity conservation	Shifting focus from production to conservation
Greenhouse climate change predictions	National	Climate uncertainty – increased need for species migration / evolution corridors	Natural resource management consequences not yet apparent
Increasing recognition of the importance of salinity	National	More funding, policy status, R&D and planning focusing on salinity management	NAP provides a degree of investment certainty for natural resource management agencies

Much rural policy has been based on a sentiment opposing direct intervention by governments. Natural resource management policy in Australia continues to be based on encouragement, voluntary adoption and the provision of information, with limited use of regulatory powers (Williams and Walcott 1998). However, in Victoria legislation has been used to regulate some aspects of land management — most notably via the introduction of vegetation clearance controls in 1988, which are applied through state-wide planning controls, and more recently the Victorian Farm Dams Legislation.

Over time, regional economy and land use practices have evolved. It is now useful to redefine these landscapes as ‘mixed landscapes’ in the sense that they are part of a mixed economy in which production, lifestyle and recreation values are intermingled. Rural property prices reflect these values, as does the prevalence of small-lot subdivisions, the ‘rural housing boom’ (3000 new houses since the 1970s<sup>3</sup>) and the increasing importance of tourism and recreation in the regional economy (Abel, pers. comm.). The rising disparities in wealth between urban and regional economies (National Economics and ALGA 2001) can help to explain the increasing investment of urban capital in rural regions with desirable lifestyle characteristics.

### *Integrating natural resource management and other planning mechanisms*

Regions consist of a matrix of land systems, uses and tenures. Infrastructure, markets and agronomic factors tend to concentrate certain land uses onto preferential land systems, e.g. intensive industries on preferred soils, etc. Regional natural resource management planning is often focused on prioritising the expenditure of public funds on landscape repair, rather than skilfully choosing and using a wider range of public policy instruments that have the effect of catalysing market forces, generating new investments and promoting innovation to achieve positive landscape change.

Improvements in the integration of natural resource management, statutory planning and regional strategic planning are recognised as a priority in Victoria. The reviews of Regional Catchment Strategies (RCSs) and Municipal Strategic Statements (MSSs) provides an ideal opportunity to ensure greater alignment (RMIT 2001).

As these processes mature they are becoming more capable of providing frameworks for applying policy directions, and of providing strategic guidance based on integrating multiple objectives and large quantities of information. However, the responsibility for implementing natural resource management plans is still diffused across many agencies (Johnson et al.1999) and relies largely on persuasive powers, publicly funded grants and voluntary efforts. Links to regulatory processes and statutory planning functions of governments have historically been poor.

Planning in Victoria is multi-tiered; natural resource management planning is primarily the role of the Department of Sustainability and Environment and the Catchment Management Authorities, while statutory planning responsibility rests primarily with the Department of Infrastructure and local government. It is widely recognised that many opportunities arise from a closer alignment between natural resource management and the statutory planning system (RMIT 2001). The scope of natural resource management programs and related legislative and policy frameworks has expanded over the past two decades, driven by the need to address emerging priorities: soil erosion, land care, salinity, water and catchment issues, vegetation; biodiversity, etc. and to resolve policy conflicts in water, forestry, vegetation and threatened species management (Industry Commission 1992; Commonwealth of Australia 1991, 1992, 1996; HRSCEH 2000).

Local government development control and land use planning functions have evolved during the same period. These increase the potential for local government intervention in both the built (towns) and the rural environment, although many of the potential mechanisms are rarely used in rural areas.

---

<sup>3</sup> Bill Cathcart – Delatite planner workshop presentation

The Victorian government's planning system provides a legislative framework that offers much potential for integrating the catchment (natural resource management) and the statutory planning regimes. The amalgamation of local governments in rural Victoria elevated the physical area of local government to the subregional scale where, in theory they are big enough to address regional economic, infrastructure and natural resource management issues. The planning framework provides strong linkages between state-wide policy and local decisions. Municipal Strategic Statements provide a strategic framework for statutory planning.

Local planning regimes tend to focus on the development approvals process rather than the management of existing enterprises. Yet landscape sustainability issues are typically water (at the catchment scale) and vegetation and biodiversity (at the bioregional scale).

Their management is the result (or often the byproduct) of all activities across all tenures. Developing mechanisms which directly manage these processes and resources is a marked change from those designed to regulate new land use and development proposals. However, statutory planning could play a key role in directing new proposals into certain preferred parts of the landscape, and in providing a systematic framework for beneficial landscape change.

An improvement in integrated natural resource management could be achieved by the use of detailed subregional and local plans backed by the statutory planning processes. The resultant plans require greater detail, increased spatial resolution and the definition of different zones within each region. They should identify zones with clearly defined future uses and specify the intensity of use for each zone. For example, the plans may identify preferred areas for habitat reconnection or areas suitable for further intensification. Until subregional plans become more specific they will be unable to direct landscape change to the degree that is necessary.

In many parts of Australia, many agricultural, horticultural and viticultural developments sit outside the land use planning and development approvals process. Some development proposals like intensive animal industries trigger the development approvals process.

In South Australia, local government development permits are required for changing land use from pasture or dryland cropping to new irrigated developments. This is in contrast to most parts of New South Wales and Victoria where irrigated viticultural and horticultural developments do not require a local authority development approval in most rural zones. For example, in Victoria generally no planning permit is required to establish a vineyard as it is accepted as a rural land use. However, a permit is required if the proposed development involves transfers of water rights, because it triggers salinity hazard assessments in certain areas.

### *Subdivisions: threat or opportunity*

There is considerable pressure to subdivide rural land throughout much of the Goulburn Broken Catchment, as is the case many other parts of Victoria. Many landscapes are increasingly more highly valued in the market for lifestyle and recreation purposes than for their value for agricultural production (see Barr 2002). This represents a shift in society's values and a change in the relative purchasing powers of 'urban' values.

Hobby farms and recreation are significant contributors to the region's economy and given the size of Melbourne population and the ease of access via major roads this is likely to continue. The close proximity of the Goulburn Broken Catchment to Melbourne has ensured that it is a favoured destination for recreational trips, hobby farms, retirement, and so on.

The dryland parts of the Goulburn Broken catchment are changing as a result of many people moving in for lifestyle reasons; these people are purchasing 'lifestyle values' when they buy land and the right to occupy it. These buyers bring new financial capital, skills and values to the catchment. New enterprises are likely to emerge, and many older enterprises, such as retailing, building and construction, are increasingly servicing this growth industry. For example, more road materials are required to upgrade country lanes and build tracks into houses dispersed across former farmland. Frequently, these new houses are located to take in inspirational views.

Healthy and beautiful landscapes are essential for much of the lifestyle and recreation-based industries. It is why many people want to live or holiday in the region (CSIRO 2001). In the

dryland parts of Goulburn Broken Catchment a healthy landscape is critical to many industries: it underpins the real estate prices more than primary production. In fact, because of the high aesthetic values, much rural property is purchased for lifestyle reasons and therefore competes with those wanting the land for primary production (Neil Barr, pers. comm.). People want to live there because they like the landscape, the place, and the sense of satisfaction they gain from the location.

The value of these landscapes is increased by the ready access to Melbourne via the Hume, Melba and Maroondah Highways; for many of Melbourne's 3.8 million people the Goulburn Broken Catchment is a playground, a retirement dream or a holiday house. This shift can be seen as treat or opportunity for more sustainable land use but outcomes will depend how well the planning is executed. One option is that farms are not subdivided into small blocks but that cluster or strata title developments are favoured. Another option is that all subdivision and development approvals in sensitive rural areas need to demonstrate net environmental gain by increasing vegetation cover or similar.

### *Statutory planning, local government and the MSS reviews*

The project set out to identify how the planning systems and specific planning instruments can be used to deliver, support or facilitate landscape change. It is important to recognise that the Victorian planning system has recently shifted from one based on development approvals to one which attempts to ensure strategic guidance via the MSS of each municipality. While history demonstrates that development controls are slow and *ad hoc*, with only a limited capacity to ensure regional outcomes are achieved, it is still too early to determine if the strategic approach will be any more capable. Unless these are guided by a framework of regional or catchment scale strategies, they will almost certainly not deliver adequately on catchment health.

Up to 30 years of rural subdivision has led to much fragmentation of farm-scale titles in the mid and upper catchments. This has resulted in an *ad hoc* tenure system with large areas of small and medium lot sizes. Furthermore, there is considerable pressure to continue rural residential subdivision. Unless local government is prepared to use the 2002 MSS review to adopt a different direction, it is unlikely that the statutory planning system will be used to drive or facilitate landscape change.

The consequences of this history of small lot development are that there are many part time farmers, hobby blocks and farming enterprises operating across numerous titles. The small average title size represents an impediment to major investment in plantation forestry or other industrial scale activities. Other factors such as distance to ports also represent a handicap to efforts to attract large scale investment in plantation forestry.

The CMA needs to identify those drivers of catchment health that can be usefully regulated or strategically directed by the land use planning system, and then apply sufficient pressure to ensure inclusion in the Local Planning Schemes through the State Planning Policy Framework, the Councils' MSSs or their local planning provisions.

The CMA can call into question local policies and strategies. The councils are obliged to ensure that their MSSs are consistent and give expression to the geographic strategies of the CMA such as the RCS.

### *Regulations, incentives to duty of care*

A simplistic approach to landscape change would be to more heavily regulate land use, e.g. prohibit grazing on all slopes greater than 15°. Compensation could be paid for the grazing rights, and aerial surveillance could be used to ensure compliance. Such regulations would probably be unpopular, but they would be accepted over time, and the regional economy would adapt. Sloping land would then only be available for other land uses, such as forestry, conservation, recreation or firewood production. The latter may be a viable alternative business, particularly if governments induced scarcity by reducing access to native forests for firewood (VNPA 2000).

There are many reasons why governments have been reluctant to use land use regulation as a tool to help reduce the environmental impacts of agriculture. They include the historic

political power of the farm lobby, the physical vastness of the Australian land mass, and the perceived difficulty of enforcement (Williams and Walcott 1998). While hard regulation is often considered unworkable, a wide range of voluntary and financial mechanisms can be used as alternatives. For example, management agreements, covenants and revolving funds can be used to protect high-value or vulnerable land. the development of industry codes and the definition of best or acceptable practice can also generate change by way of industry ‘self-regulation’.

The use of self-regulation is promoted as an alternative to ‘hard regulation’. In 1998 the Industry Commission called for greater self-regulation, applications of ‘duty of care’ and the introduction and application of codes of practice, because of the economic impacts of the environmental degradation caused by agriculture (Industry Commission 1998). Since then there has been a call to more clearly define ‘duty of care’.

The reason for needing the definition is clear: until the duty of care (or socially accepted practice) is defined, how can incentives paid for by the public be targeted to those who are generating real social value? Furthermore, without a clear definition how can regulation be designed and targeted to those operators that are generating unacceptable high social costs? (See Figure 2 for a diagrammatic representation.)

The Industry Commission (1998) recommended adoption of the principles of ‘duty of care’ for environmental management, and that voluntary standards and codes of practice should be used to guide environmental management as far as possible.

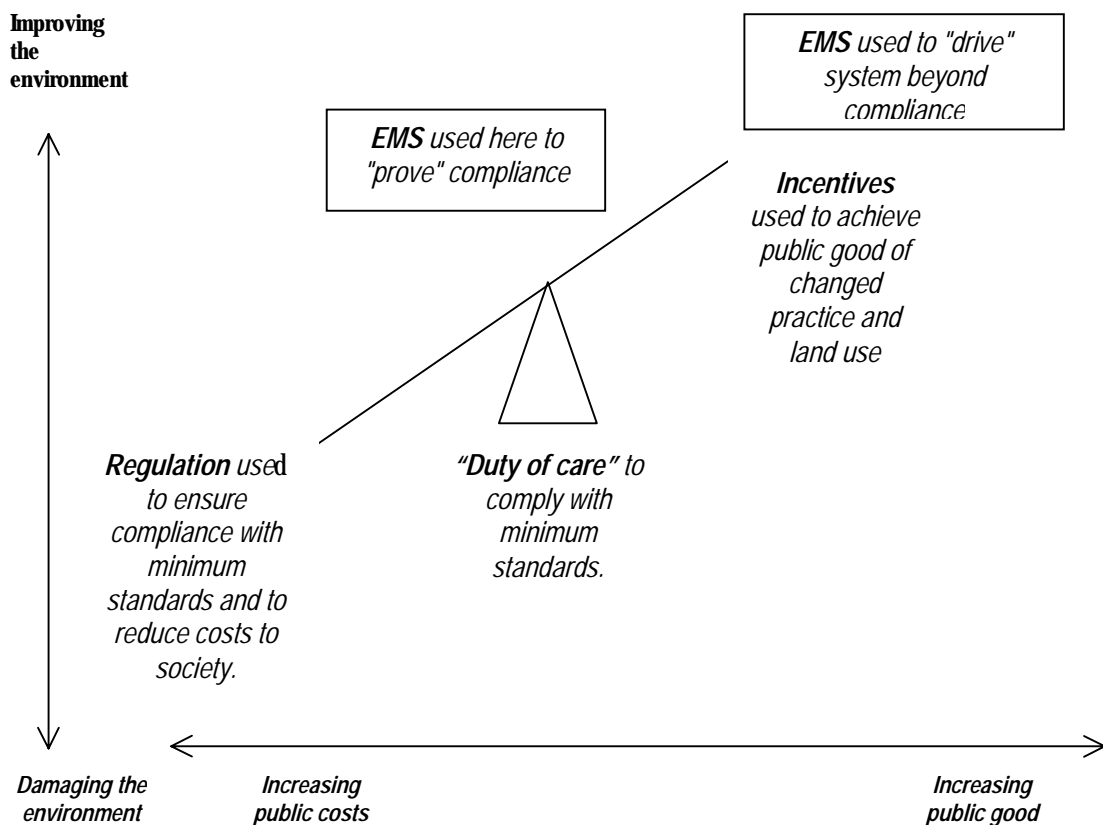


Figure 2 The duty of care see-saw.

This continues a long tradition of low or self-regulation for rural industry; history shows that most Australian state and local governments only reluctantly impose environmental controls or land use planning regimes in rural areas. The reluctance by the states to regulate rural land use is contrary to numerous national inquiries recommending the introduction of land use policies that would regulate agricultural businesses, and is in direct contrast to urban land use, which is relatively heavily regulated (William and Wallcott 1998).

A key challenge for governments is to determine how they can support and enhance the capacity of businesses to sponsor and reward long-term environmental responsibility which is over and above the expected or regulated minimum. Furthermore, the tailoring of this 'regulation' to the diversity of agricultural businesses will require a focus on elegant and adaptable regulation or the use of voluntary systems such as environmental management systems (Anderson et al. 2000).

Environmental management systems (EMSs) focus on embedding environmental responsibility in commercial operations but they work better when guided by clear policy and regulatory regimes. If governments intend using EMS they need to clearly define the responsibilities of the commercial operators (Alexandra 1999).

Regulation plays a key role in signaling to commercial operators what is expected in terms of societal responsibilities. Incentives should be used to support operators who exceed minimum standards, to generate public goods, or to assist business transition, but should not be used as a continuing subsidy to businesses.

Differential local government rates can be a powerful incentive to support those operators who are exceeding minimum standards and generating positive environmental outcomes. Some shires are already offering these incentives to owners and managers of rural land who implement environment management programs.

## **Investing in landscape change**

### *A regional vegetation bank?*

The project has sought to identify opportunities for leveraging private investment in landscape change. Because of the need for large-scale revegetation and the need to reduce leakage to control salinity via dramatically increasing plant water use across the landscape (MDBC 1999a, Walker et al. 1999, MDBC 2000c, Stirzacker et al. 2000), a variety of potential forestry and revegetation options have been investigated. While these include 'traditional' plantations in suitable areas, other forms of environmental and multi-purpose forestry have been assessed (Bioenergy Australia 2000; JVAP 2000, 2001a). These are particularly important in those parts of the landscape often deemed unsuitable for traditional plantations because of slope or lower rainfall. Attracting investment in semi-commercial forestry has been a focus of the work.

The project reviewed recent publications on ecosystem services, leveraging private investment and on bringing greater investment to semi-commercial forestry (for example, CSIRO et al. 2001, JVAP 2002, Productivity Commission 2002). JVAP (2002) argued for a regional-scale pilot program to advance the design of investment models along the lines proposed.

The consultants have prepared a preliminary 'prospectus' for a Reafforestation Investment Scheme (RIS) for the Goulburn Broken Catchment Management Authority. This proposes a simple structure and the linking of several currently separate financial mechanisms. It focused on those aspects of landscape change that have the potential for generating medium-term to long-term returns from future timber, catchment health outcomes and future carbon credits.

The landscapes of the mid and upper catchments were categorised according to their prospective productivity under several forestry options. This drew on the recent work of Bernie Robb in assessing the potential for farm forestry in the mid Goulburn Broken Catchment. A detailed financial model was constructed and used to generate 24 different scenarios. All assumptions about growth rates incentives and future markets are transparent and can be changed as required. The scenarios demonstrate the importance of either carbon credits or catchment health incentives in terms of attracting significant investment to land use change.

In addition to the prospectus, the project contributed to the design of the market-based instruments trial in conjunction with the Department of Natural Resources and Environment. This trial will extend the BushTender methods into a tender system for multi-benefit landscape change. It is expected that landholders will tender for incentive payments to de-stock and stimulate natural regeneration in rough grazing paddocks.

Much of the landscape in which change is required currently generates a low return on capital and the businesses have little internal capacity to invest in change. However the low rates of return mean that alternative land uses have a low return hurdle to overcome. There are therefore potentially many opportunities in terms of generating income via a combination of conventional products, such as forestry, and ecosystem services such as improved water quality. This combined or multi-purpose forestry could then operate in areas that are currently regarded as sub-commercial for plantations. By using 'forestry rights', a forestry and ecosystem services company could operate over large areas without buying land (see Alexandra and Hall 1998).

It is important to recognise that not all trees will generate the same catchment health benefits and that a detailed understanding of where to place trees in the landscape will be required (Stirzaker et al. 2002).

### *Finding investors*

The National Action Plan for Salinity and Water Quality (NAP) and the second round of the Natural Heritage Trust are both major public sector funders of natural resource management activities, but additional sources of investment are needed to accelerate rates of landscape change because of the scale of change required.

The Australian Conservation Foundation and the Business Leaders Round-table commissioned the Allen Consulting Group to report into how to leverage greater private sector investment into natural resource management (ACG 2001). They have proposed innovative investment and financing models that will broker public and private funds. These will build on the considerable public investment in environmental/natural resource management programs and unprecedented community involvement in projects like riparian zone restoration, remnant vegetation protection and revegetation. For example, both the Murray–Darling Basin Commission and the Goulburn Broken CMA are talking about a proposed 'vegetation bank' for brokering public and private investment in natural resource management and using a range of investment pathways and mechanisms.

By taking a hard look at vegetation plans of each CMA and estimating the cost of achieving these targets, it is possible to get a sense of how much money must flow (NRE 2000). It is clear that this amount is not coming from NAP or state government.

### *Where will it come from?*

**New woody industries.** Some investment may come from commercial investors in farm forestry such as blue mallee plantations, if and when the necessary industry development and commercialisation steps are taken. The Joint Venture Agroforestry Program has an established approach to supporting the development of this kind of farm forestry industry but so far few new commercial woody industries are in the late stages of commercialisation (JVAP 2000, 2001b).

**Carbon forests.** Some investment might come from selling carbon credits to Japanese or Australian power companies. But so far there is a very limited market in carbon, and lots more talk about ecoservices than actual transactions. In some landscapes forestry may be a suitable alternative in its own right, and where it is subcommercial, a range of ecosystem services 'subsidies' or bonuses could underwrite the investment.

**Public or private investment in environmental restoration plantings.** If we are to overcome the imminent threats of extinction of up to 50% of small woodland birds it is clear that many parts of the Australian landscape need major restoration efforts (Seddon et al.2001). The community clearly supports the idea of restoring rural environments. Sherwin (1993) identified

options for creating a 'green web' in order to enhance habitat. Furthermore, it is easy to image future forests that have multiple objectives including well-defined biodiversity objectives and that the costs of ensuring these are met are shared equitably (Productivity Commission 2001).

Local, state and Commonwealth governments could be either major investors into a vegetation bank, or perhaps a better option is that they could use their low risk to attract commercial investors into the bank. The Allen Consulting Group identified that more than \$68 billion of new investment funds are available for suitable investments each year in Australia (ACG 2001, JVAP 2002).

#### *A hierarchy of cost-effectiveness of investments*

A clearer set of criteria for determining the cost-effectiveness of investment is required to target natural resource management funds. It seems that a logical hierarchy is based on the principle that the most cost-effective investments are those that protect functional ecosystems and the productive capacity of natural resources by preventing further decline, while the least cost-effective are investments in restoring badly degraded systems. This hierarchy is illustrated in Table 3, with cost-effectiveness and chances of success decreasing down the table, and cost and associated risks increasing down the table. There are complex sets of scale issues involved, and in general the principle can be applied across a range of scales, from a copse of trees to a river system.

**Table 3** A hierarchy of outcomes based on cost-effectiveness. Reading down the table: Cost-effectiveness and chances of success decrease down the table; costs and risks increase down the table.

Focus of projects	Example of project	Project costs
Protection of functional ecosystems	Proto-type projects which demonstrate BMP. Support for effective planning and regulatory arrangements which protect wetlands and remnant vegetation.	Cost of developing effective planning policies under existing legislation.
Changes in management to protect functional systems	Reduction in grazing pressure to a level which sponsors episodic regeneration of wetland fringes and woodland trees.	Cost of understanding and communicating regeneration processes.
Interventions to stimulate regeneration	Direct seeding of pioneer species to encourage forest regrowth along forest or wetland fringes and riparian zones.	Cost of direct seeding. The rest is triggered by natural regeneration processes.
Repair	Modify structures that regulate water inflows to allow for periodic flooding.	Moderate costs of works, e.g. replanting.
Restoration / re-creation	Attempt to recreate a wetland by intensive engineering and landscaping.	Very costly: equates to cost of complete restoration if possible.

#### *Low-cost revegetation*

Increasing vegetation cover is a recognised priority for much of rural Victoria and the Murray–Darling Basin (NRE 2000, Nambiar et al. 2000, MDBC 2002, MDBC and CSIRO 2002). The prospectus identifies a number of different options for achieving this. These can be considered to occur on a spectrum from fully environmental (e.g. riparian zone restoration) to fully commercial (e.g. Radiata Pine plantations on commercial sites).

The financial modelling demonstrates the importance of cost-effective, or least cost revegetation, especially where there are no, or limited, prospects of commercial outcomes.

Further work is required in developing reliable low-cost techniques suited to the range of conditions within the catchment. For example, there are over 30 000 ha of cleared land on slopes greater than 18° slope where the rainfall exceeds 700 mm. This is clearly unsuited to traditional plantation establishment techniques. This work should focus on the following opportunities:

- improving direct seeding in arable landscapes
- mixing direct seeding of pioneer species with precision planting of preferred plantation species in alternate rows or blocks to lower the costs of plantations in low rainfall areas
- improving techniques for enhancing natural regeneration
- aerial seeding of steeper slopes
- aerial ‘bombardment’ of seedling spear-tubes using technology pioneered by Lockheed Aerospace.
- combinations of the above, e.g. natural regeneration plus enrichment seeding.

## Conclusions

The project has attempted to evaluate current and future options for stimulating landscape change. It has concluded that governments must design and implement a concerted policy reform process on a scale equivalent to the water reform agenda. To be successful this must align a variety of policy instruments into a policy framework which:

- develops the capacity of new and existing landholders to change land use practices
- facilitates the adoption and growth of new business models which operate ‘beyond tenure’
- introduces substantial new investment into reforestation, as described above
- ensures that the land use planning system supports and facilitates the necessary changes
- introduces new incentives aimed at restoring catchment health
- ensures that biodiversity is protected and habitat enhanced
- introduces new property rights, particularly carbon credits linked to global carbon markets
- supports a complex mixed economy based on the lifestyle, recreation and ecosystems values of the region.

Although the project has a clear GBCMA focus, it is important to note that the scale of such a reform process is likely to be national, or at least throughout the Murray–Darling Basin. The Landmark Task 5 project ‘Analysis and Development of Policy Options to Promote Sustainable Land Use within Dryland Regions of the Murray–Darling Basin’ is testing the support for various policy reforms via an extensive consultative process (Landmark 2002). Similarly, the Heartlands Project is assessing and developing some of the prospective technical responses, including multi-purpose farm forestry (MBDC and CSIRO 2002).

The Goulburn Broken Catchment Management Authority and Victoria as a whole have an important opportunity to pilot comprehensive reform processes that focus on changing land use in the upland catchments.

[Return to front page](#)

## Bibliography

- AACM International (1995) *Cost Sharing Frameworks for On-ground Works*. Murray–Darling Basin Commission: Canberra.
- ABC Radio National (2002) Background Briefing: ‘Corporate welfare’. Australian Broadcasting Commission, July 2002.
- ABS (1996) *Australian Agriculture and the Environment*. Australian Bureau of Statistics: Canberra.
- ACF (2000) Natural advantage — a blueprint for a sustainable Australia’. *Habitat* (special supplement).
- ACG (2001) *Repairing the Country: Leveraging Private Investment*. The Allen Consulting Group: Melbourne.

- Alexandra J. (1992) Water and the environment in Australia. **In** Johnson, M. and Rix, S. (ed.) *Water in Australia*. Pluto Press: Sydney.
- Alexandra J. (1996) Sustainable natural resources management — who should foot the bill? Occasional Paper, Land and Water Resources Research and Development Corporation, Canberra (prepared for the ABARE Outlook Conference 1996).
- Alexandra J. (1997) Adjusting natural resources management to ecological realities — is there any role for the Rural Adjustment Scheme? Occasional Paper Land and Water Resources Research and Development Corporation, Canberra.
- Alexandra J. (1999) *Environmental management systems for Australian Agriculture*. Rural Industries Research and Development Corporation: Canberra.
- Alexandra J. (2000) *Sustainability Indicators for NE Victoria*. Department of Natural Resources and Environment: Benalla.
- Alexandra J. and Hall, M. (1998) Creating a viable farm forestry industry in Australia – what will it take? Publication No. 98/74. Rural Industries Research and Development Corporation: Canberra.
- Anderson, S., Lowe, K.W., Preece, K. & Crouch, A. (2001) Incorporating biodiversity into environmental management systems for Victorian agriculture: a discussion paper on developing a methodology for linking performance standards and management systems. Department of Natural Resources and Environment: East Melbourne (accessed at [www.nre.vic.gov.au](http://www.nre.vic.gov.au)).
- ANZECC and AWRC (1992) *National Water Quality Management Strategy, Policies and Principles*. Draft Reference Document. ANZECC and AWRC: Canberra xx
- AATSE (1999) *Water and the Australian Economy*. Australian Academy of Technological Sciences and Engineering.
- AGO (1998) *Greenhouse Challenge. Vegetation Sinks Workbook: A Summary*. Australian Greenhouse Office: Canberra.
- Barr, N (2002) Victoria's Small Farms. Research Report 10. Centre for Land Protection Research, Department of Natural Resources and Environment: Bendigo.
- Bates G (2001) A Duty of Care for the Protection of Biodiversity on Land. A Consultancy Report to the Productivity Commission. Commonwealth of Australia: Melbourne.
- Bennett A (1990) *Habitat Corridors: Their Role in Wildlife Management and Conservation*. Department of Conservation and Environment: East Melbourne.
- Binning C and Feilman P (2000) Landscape conservation and the non-government sector. Research Report No. 7/00, Land and Water Resources Research and Development Corporation: Canberra.
- Binning C and Young M (1997) Motivating people using management agreements to conserve remnant vegetation. Report for the National Research and Development Program on Rehabilitation, Management and Conservation of Remnant Vegetation. Environment Australia: Canberra.
- Binning C and Young M (1999) Conservation hindered. The impact of local government rates and state land taxes on the conservation of native vegetation. Report for the National Research and Development Program on Rehabilitation, Management and Conservation of Remnant Vegetation. Environment Australia: Canberra.
- Binning C, Saker B, Meharg S, Cork S and Kearns A (2000) Making farm forestry pay. Markets and incentives for ecosystem services. Draft report. CSIRO and Joint Venture Agroforestry Program.
- Bioenergy Australia (June 2000) *Biomass Energy and Products*. Bioenergy Australia: Sydney.
- BRS (1999) *Country Matters: A Social Atlas of Rural and Regional Australia*. BRS: Canberra.
- Commonwealth of Australia (1991a) *The National Strategy for Ecologically Sustainable Development*. AGPS: Canberra.
- Commonwealth of Australia (1992) National Water Quality Management Strategy. Australian Water Resources Commission and ANZECC, Canberra.
- Commonwealth of Australia (1996a) *Australia: State of the Environment*. Commonwealth of Australia: Canberra.

- Commonwealth of Australia (1996b) *The National Strategy for the Conservation of Australia's Biodiversity*. Environment Australia: Canberra.
- CSIRO (2001) *Natural Assets: An Inventory of Ecosystem Goods and Services in the Goulburn Broken Catchment*. CSIRO Sustainable Ecosystems: Canberra.
- CSIRO (2002) *The Heartlands Initiative. Five Year Plan 2001–2005*. CSIRO: Collingwood.
- CSIRO, ANU Department of Forestry, RIRDC, Olsen & Vickery, and Hester Gascoigne & Associates (2001) *The Contribution of Mid to Low Rainfall Forestry and Agroforestry to Greenhouse and Natural Resource Management Outcomes, Overview and Analysis of Opportunities*. Australian Greenhouse Office and Murray–Darling Basin Commission: Canberra.
- Dore, J. and Woodhill, J. (1999) *Sustainable Regional Development. An Australia Wide Study of 'Regionalism' Highlighting Efforts to Improve the Community, Economy and Environment of Regions by Regions*. Greening Australia: Canberra.
- Dovers, S. (1996) Processes and institutions to inform decisions in the longer term. **In** *Tracking Progress*. Proceedings of the Australian Academy of Science Fenner Conference on the Environment, October 1996. Institute of Environmental Studies, UNSW: Sydney.
- Dovers, S. and Mobbs, C. (1999) Social, Economic, Legal, Policy and Institutional R&D for Natural Resource Management: Directions For LWRRDC, LWRRDC Occasional Paper 01/99, Land and Water Resources Research and Development Corporation, Canberra.
- Dwyer, G., Hughes, P., Jones, A. and Peterson, D. (2001) *Harnessing Private Sector Conservation of Biodiversity*. Productivity Commission: Melbourne.
- Earl, G., Stelling, F., Titcumb, M. and Berwick, S. (2001) *Revegetation Guide for the Goulburn Broken Catchment*, Department of Natural Resources and Environment, Sydney.
- Environment Australia (1996) Subsidies to the use of natural resources in Australia. *Environmental Economics Research Paper No.2*, Environment Australia: Canberra.
- ECC (2001) *Box–Ironbark Forests and Woodland Investigations Final Report*. Environment Conservation Council: Melbourne.
- GBCMA (2001) *Guidelines for Waterway Grants in the Goulburn Broken Catchment*. Goulburn Broken Catchment Management Authority.
- Hobbs, R.J and Yates, C.J. (eds) (2000) *Temperate Eucalypt Woodlands in Australia*. Surrey Beatty & Sons: Chipping Norton: NSW.
- HRSCEH (House of Representatives Standing Committee on Environment and Heritage) (2000) *Co-ordinating Catchment Management: Report of the Inquiry into Catchment Management*. Commonwealth of Australia: Canberra.
- Industry Commission (1998) A Full Repairing Lease. Inquiry Into Ecologically Sustainable Land Management, Report No. 60. Industry Commission: Melbourne.
- Industry Commission (1992) *Water Resources and Waste Water Disposal*. Industry Commission: Melbourne.
- Industry Commission (1996) *State, Territory and Local Government Assistance to Industry*. Draft Report. Industry Commission: Melbourne.
- Institute of Environmental Studies (1996) *Tracking Progress*. Proceedings of the Australian Academy of Science, Fenner Conference, on the Environment, October 1996. Institute of Environmental Studies, UNSW: Sydney.
- Johnson A.K.L. Cowell S.G., Loneragan N.R. and Dews, G. (1999) Sustainable Development for Tropical Australia, LWRRDC Occasional Paper, Land and Water Resources Research and Development Corporation: Canberra.
- JVAP (2000) *Emerging Products and Services from Trees in Lower Rainfall Areas*. Rural Industries Research and Development Corporation: Canberra.
- JVAP (2001a) *Agroforestry and Farm Forestry JVAP Completed Projects in 2001 and Research in Progress as at June 2001*. Rural Industries Research and Development Corporation: Canberra.
- JVAP (2001b) *The Carbon Farmer Model. Volume 1: Main Report*. Rural Industries Research and Development Corporation: Canberra.

- JVAP (2002) *Achieving Environmental and Commercial Outcomes Through Agroforestry — Policy and Investment Options*. Rural Industries Research and Development Corporation: Canberra.
- Landmark (2002) Sustainable land use in dryland regions of the Murray–Darling Basin, Policy Discussion Paper. Landmark Project: Brisbane.
- Lindermayer, D. (2001) *Plantation Design and Biodiversity Conservation*. Rural Industries Research and Development Corporation: Canberra.
- LWRRDC (1998) Data Sheets On Natural Resources Management, LWRRDC Occasional Paper 11/98, Land and Water Resources Research and Development Corporation: Canberra.
- MDBC (1996) *Cost-sharing for On-ground Works*. Murray–Darling Basin Commission: Canberra.
- MDBC (1999a) *Salinity and Drainage Strategy. Ten Years On*. Murray–Darling Basin Commission: Canberra.
- MDBC (1999b) *The Salinity Audit of the Murray–Darling Basin, A 100-year Perspective*. Murray–Darling Basin Commission: Canberra.
- MDBC (2000a) *Adjusting for Catchment Management, Structural Adjustment and its Implications for Catchment Management in the Murray–Darling Basin*. Murray–Darling Basin Commission: Canberra.
- MDBC (2000b) *Integrated Catchment Management in the Murray–Darling Basin*. Murray–Darling Basin Ministerial Council: Canberra.
- MDBC (2000c) *Basin Salinity Management Strategy 2001–2015*. Murray–Darling Basin Commission.: Canberra.
- MDBC (2001) *Basin Salinity Management Strategy. Vegetation Bank*. Murray–Darling Basin Ministerial Council: Canberra.
- MDBC (2002) *Environmental Challenges in the Murray–Darling Basin*. Murray–Darling Basin Commission: Canberra.
- MDBC and CSIRO (2002) *Heartlands Newsletter*. Autumn Edition. Murray–Darling Basin Commission: Canberra.
- MDBMC (2001) *Integrated Catchment Management in the Murray–Darling*. Murray–Darling Basin Ministerial Council: Canberra.
- Nambiar S, Cromer R and Brown A (eds) (2000) *Restoring Tree Cover in the Murray–Darling Basin*. CSIRO Forestry and Forest Products: Canberra.
- National Economics and ALGA (2001) *State of the Regions 2001*. National Economics and Australian Local Government Association.
- NRE (2000) *Restoring Our Catchments: Victoria's Draft Native Vegetation Management Framework*. Department of Natural Resources and Environment: East Melbourne.
- Productivity Commission (1999) Implementation of ESD by Commonwealth departments and agencies. Draft report. Productivity Commission: Melbourne.
- Productivity Commission (2001) *Cost-sharing for Biodiversity Conservation: A Conceptual Framework*. Productivity Commission: Melbourne
- Productivity Commission (2002) *Creating Markets for Ecosystems Services*. Productivity Commission: Melbourne
- RMIT (2001) *Catchment Management and Planning: Short Course Reading Guide*. School of Social Science and Planning, RMIT University: Melbourne.
- Seddon, J., Briggs, S. and Doyle, S. (2001) Birds in woodland: remnants of the central wheat/sheep belt of NSW. Report to the Natural Heritage Trust. NSW National Parks and Wildlife Service.
- Sherwin, C. (1993) *Broken Web — Towards a Strategy for Habitat Restoration Across The Broken Catchment, Northern Victoria*. Victorian National Parks Association: Melbourne.
- Stirzaker, R., Vertessy, R. and Sarre, A. (2002) *Trees, Water and Salt: An Australian Guide to Using Trees for Healthy Catchments and Productive Farms*. Joint Venture Agroforestry Program.
- VNPA (2000) *National Firewood Conference*. Victorian National Parks Association: East Melbourne.

- Walker, G., Gilfedder, M. and Williams, J. (1999) *Effectiveness of Current Farming Systems in the Control of Dryland Salinity*. CSIRO.
- Williams R. and Walcott J. (1998) Environmental Benchmarks for Agriculture? Clarifying the Framework in a Federal System. *Londovol* **15**(2):149–163.
- Young M.D. and McCoy. B. (1995) Building Equity, Stewardship, and Resilience into Market Based Property Rights Systems, in *Property Rights and the Environment*, CSIRO Wildlife and Ecology: Canberra.
- Young M.D., Gunningham .N, Elix .J, Lambert .J, Howard .B, Grabosky .P and McCrone .E (1996) *Reimbursing the Future: An Evaluation of Motivational, Voluntary, Price-Based, Property-Right, and Regulatory Incentives for the Conservation of Biodiversity*. Department of the Environment, Sports and Territories: Canberra.
- Youl R. (2002) Australasian Forestry in 2050. *Australian Forest Grower Magazine*.